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PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE

(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

KAZI, Ilya  
Mathys & Squire  
100 Grays Inn Road  
London WC1X 8AL  
ROYAUME-UNI


Date of mailing (day/month/year) 22 March 2001 (22.03.01)	<b>IMPORTANT NOTIFICATION</b>
Applicant's or agent's file reference IK/20844	
International application No. PCT/GB99/02822	
International filing date (day/month/year) 26 August 1999 (26.08.99)	
1. The following indications appeared on record concerning: <input checked="" type="checkbox"/> the applicant <input type="checkbox"/> the inventor <input type="checkbox"/> the agent <input type="checkbox"/> the common representative	
Name and Address JUMIK TECHNOLOGIES LIMITED Office 791 Old Brompton Street London SW7 3DQ United Kingdom	State of Nationality GB State of Residence GB Telephone No. Facsimile No. Teleprinter No.
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning: <input checked="" type="checkbox"/> the person <input type="checkbox"/> the name <input type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence	
Name and Address PVAXX TECHNOLOGIES LIMITED Kemble Business Park North Malmesbury SN16 9SH United Kingdom	State of Nationality GB State of Residence GB Telephone No. Facsimile No. Teleprinter No.
3. Further observations, if necessary: <b>A power of attorney signed on behalf of the person appearing in Box 2 above is required.</b>	
4. A copy of this notification has been sent to: <input checked="" type="checkbox"/> the receiving Office <input type="checkbox"/> the designated Offices concerned <input type="checkbox"/> the International Searching Authority <input checked="" type="checkbox"/> the elected Offices concerned <input checked="" type="checkbox"/> the International Preliminary Examining Authority <input type="checkbox"/> other:	
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. Chrem Telephone No.: (41-22) 338.83.38

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

15

Applicant's or agent's file reference IK/20844		<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB99/02822	International filing date (day/month/year) 26/08/1999	Priority date (day/month/year) 26/08/1998	
International Patent Classification (IPC) or national classification and IPC C08K13/02			
Applicant JUMIK TECHNOLOGIES LIMITED et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 4 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII <input checked="" type="checkbox"/> Certain observations on the international application</li> </ul>			
Date of submission of the demand  27/03/2000		Date of completion of this report  22.11.2000	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer  Van de Panne, V  Telephone No. +49 89 2399 8405	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/02822

**I. Basis of the report**

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

**Description, pages:**

1-14 as originally filed

**Claims, No.:**

1-30 as received on 25/09/2000 with letter of 25/09/2000

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02822

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims	1-30
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-30
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-30
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/GB99/02822

**I** The following documents (D) are referred to in this report:

D1 IE-A 97 280

D2 US-A 4 206 101

D3 WO 97/09379

**II** The new set of claims is fully supported by the application as filed and meets the requirements of Article 34 (2)(b) PCT

**III** The documents cited in the search report, in particular D1-D3, disclose extrudable PVA compositions which contain a fatty acid amide and optionally a plasticizer and/or a filler. These compositions are however converted to tablets or granulate suitable as feedstock for use in extrusion by a method itself involving extrusion. There is no disclosure of cold-pressing the tablets or pellets. The applicant has made plausible that the feedstock of the present independent claims 1 and 16, the method of the present independent claims 23 and 29 and the use according to claim 30 present specific advantages and solve the problem of extruding PVA based compositions while avoiding degradation of the polymer.

**IV** The documents cited in the search report do not disclose or suggest the combination of PVA and a superadsorbent filler. Claim 27 does not require the incorporation of a lubricant or moisture and does not require that the feedstock be cold-pressed and is thus much broader than the other claims. In the absence of experimental evidence, it not plausible that the compositions of claim 27, without further additives, can be extruded without significant polymer degradation of the PVA. This claim thus lacks support in the description and does not meet the requirements of Article 6 PCT.

It cannot be excluded that in some Designated States an objection for lack of unity will be raised might, since claim 27 is directed to a problem which is not related to the problem underlying claims 1-26, 29 and 30 and shares no technical features with these claims except for the -conventional- use of PVA as a matrix.

The description is not adapted to the present set of claims.

\*\*\*\*\*

- 15 -

## CLAIMS

1. A polymer feedstock in the form of a cold-pressed tablet or pellet for use in extrusion of an extruded product containing PVA, the cold-pressed tablet or pellet  
5 comprising a blend of PVA and up to 5% lubricant by weight to render the blend extrudable.
2. A polymer feedstock according to Claim 1 wherein the lubricant comprises a fatty acid amide.
- 10 3. A polymer feedstock according to Claim 2 wherein the fatty acid amide is a straight or branched  $C_{12}$ - $C_{24}$  fatty acid amide.
4. A polymer feedstock according to Claim 2 or 3 further comprising a plasticiser.
- 15 5. A polymer feedstock according to Claim 4 wherein the plasticiser is selected from ethylene glycol, glycerine, glycerol, triethylene glycol, low molecular weight polyethylene glycols and  $C_2$ - $C_8$  amides.
- 20 6. A polymer feedstock according to any of Claims 1 to 5 comprising up to 20% plasticiser, by weight.
7. A polymer feedstock according to any preceding claim further comprising a filler.
- 25 8. A polymer feedstock according to Claim 7 wherein the filler comprises inert, inorganic material.
9. A polymer feedstock according to Claim 7 wherein the filler comprises a superabsorbent material.
- 30 10. A polymer feedstock according to Claim 8 or 9 wherein the filler comprises both

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an inert, inorganic material and superabsorbent material.

11. A polymer feedstock according to Claim 8, 9 or 10 wherein the inorganic filler comprises calcium carbonate.

5

12. A polymer feedstock according to any preceding claim comprising, by weight, up to 50% filler, up to 5% lubricant and up to 20% of a plasticizer.

13. A polymer feedstock according to Claim 12 comprising, by weight, 5-50% filler,  
10 0.5 to 2.5% lubricant, 5 to 15% plasticizer and 40-80% PVA.

14. A polymer feedstock according to any of Claim 1-13, further comprising an additional lubricant component to reduce adhesion of the polymer feedstock to surfaces.

15 15. A polymer feedstock according to Claim 14 wherein the additional lubricant comprises a stearate.

16. A PVA-containing polymer feedstock in the form of a cold-pressed tablet or pellet comprising, by weight:-

20 40 to 80% PVA;  
5 to 50% filler;  
5 to 15% plasticizer; and  
0.5 to 2.5% lubricant.

25 17. A polymer feedstock according to Claim 16, comprising, by weight:-  
40 to 70% PVA;  
20 to 50% filler;  
8 to 15% plasticizer;  
0.5 to 1.5% internal lubricant; and  
30 0.0001 to 0.1% external lubricant.



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18. A polymer feedstock according to Claim 16 or 17, wherein a fatty acid amide is provided as internal lubricant.

19. A polymer feedstock according to Claim 16, 17 or 18, wherein stearate is provided  
5 as external lubricant.

20. A polymer feedstock according to Claim 17 comprising, by weight:-

50 to 60% PVA;

30 to 40% stearate-coated calcium carbonate;

10 8 to 15% glycerol;

0.5 to 1.5% octadecanamide; and

0.0001 to 0.1% zinc stearate.

21. A polymer feedstock according to any preceding claim prepared substantially  
15 without melting of the PVA.

22. A polymer feedstock according to any preceding claim having a moisture content less than about 10% by weight but greater than 0.01% to bind the pellets or tablets.

20 23. A method of making a PVA-containing polymer feedstock comprising blending PVA with a lubricant, said lubricant including a fatty acid amide in the presence of an amount of moisture sufficient to bind the polymer feedstock into tablets or pellets upon cold pressing and cold pressing the feedstock into tablets or pellets.

25 24. A method according to Claim 23 comprising blending, in a high speed blender, PVA with up to 5% by weight of lubricant.

25. A method according to any of Claims 22 to 24 comprising adding moisture to the components to be blended.

30

26. A method according to any of Claims 23 to 25 wherein PVA and lubricant are fed

- 18 -

into a high speed mixer gravimetrically.

27. A method of making a PVA-containing polymer feedstock comprising blending PVA and a filler, wherein the filler comprises a superabsorbent material.

5

28. A method according to Claim 27 comprising blending PVA and a superabsorbent material in the presence of sufficient moisture to bind the polymer feedstock into tablets or pellets upon cold pressing.

10 29. A method of extruding a PVA-containing polymer feedstock comprising blending PVA and at least one of a lubricant and a filler to form a feedstock for an extrusion process, the feedstock being in the form of pellets or tablets, and extruding the feedstock into a product, wherein the feedstock is prepared substantially without melting of the PVA.

15

30. Use of a fatty acid amide in an amount of 0.5% to 1.5% by weight as an internal lubricant together with use of an external lubricant in an amount of 0.0001 to 0.1% by weight in the manufacture of a cold-pressed polymer feedstock containing PVA and up to 50% filler wherein the feedstock is manufactured by cold pressing into pellets or tablets  
20 using residual moisture to bind the pellets or tables and substantially without melting of the PVA.

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>IK/20844</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 99/ 02822</b>	International filing date (day/month/year) <b>26/08/1999</b>	(Earliest) Priority Date (day/month/year) <b>26/08/1998</b>
Applicant <b>JUMIK TECHNOLOGIES LIMITED et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. \_\_\_\_\_



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.



None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02822

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C08K13/02 C08L29/04 //(C08K13/02,5:20,3:26)

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08K C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 206 101 A (WYSONG ROBERT D) 3 June 1980 (1980-06-03) column 4, line 50 -column 5, line 1; claims 1,12; example 1 ---	1-5,33
X	IE 970 280 A (SOLPLAX LIMITED) 24 September 1997 (1997-09-24) examples ---	1,2,5,8, 24,25
X	WO 97 09379 A (SOLPLAX LTD.) 13 March 1997 (1997-03-13) claims ---	1,2,5,8, 24,25
A	WO 96 20973 A (ENVIRONMENTAL PACKING L P) 11 July 1996 (1996-07-11) claims 1,7,8; examples ---	1,8-12
	-/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

14 December 1999

Date of mailing of the international search report

22/12/1999

Name and mailing address of the ISA

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Authorized officer

Engel, S

## INTERNATIONAL SEARCH REPORT

International Application No

T/GB 99/02822

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 713 965 A (WIDIGER A ET AL) 30 January 1973 (1973-01-30)  column 1, line 68 -column 2, line 46; claims 1,4  ----	1-3,9, 10, 13-15, 18,19  .
X	US 3 470 122 A (RIDGEWAY LEE R ET AL) 30 September 1969 (1969-09-30) column 3, line 4 - line 13; claims 1-3  -----	1-3,9,10

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

T/GB 99/02822

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4206101	A	03-06-1980	AR 204185 A	28-11-1975
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			AU 7684674 A	24-06-1976
			BE 824048 A	02-05-1975
			BR 7500016 A	04-11-1975
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			EG 12597 A	30-09-1979
			ES 433500 A	16-05-1977
			FR 2256942 A	01-08-1975
			GB 1472241 A	04-05-1977
			IL 46382 A	10-03-1978
			IT 1028145 B	30-01-1979
			JP 50098952 A	06-08-1975
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			ZA 7500020 A	28-01-1976
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			WO 9839382 A	11-09-1998
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			CA 2231163 A	13-03-1997
			EP 0848730 A	24-06-1998
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			AU 4421196 A	24-07-1996
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			DE 1694685 A	21-10-1971
			FR 1509503 A	27-03-1968
			GB 1113082 A	
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>C08K 13/02, C08L 29/04 // (C08K 13/02, 5:20, 3:26)</b>		<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/12615</b>
			<b>(43) International Publication Date:</b> 9 March 2000 (09.03.00)
<b>(21) International Application Number:</b> PCT/GB99/02822 <b>(22) International Filing Date:</b> 26 August 1999 (26.08.99) <b>(30) Priority Data:</b> 9818604.2      26 August 1998 (26.08.98)      GB <b>(71) Applicant (for all designated States except US):</b> JUMIK TECHNOLOGIES LIMITED [GB/GB]; Office 791, Old Brompton Street, London SW7 3DQ (GB). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> STEVENS, Henry, Guy [GB/GB]; Ballacriy Manor, Colby, Isle of Man (GB). <b>(74) Agents:</b> KAZI, Ilya et al.; Mathys & Squire, 100 Grays Inn Road, London WC1X 8AL (GB).			<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> PVA-CONTAINING COMPOSITIONS			
<b>(57) Abstract</b>  An extrudable PVA-containing composition is disclosed, which enables PVA articles to be manufactured on conventional extrusion apparatus. The composition includes a lubricant, such as a fatty acid amide, most preferably octodecanamide and is most preferably formed into pellets by cold pressing. The compositions are suitable for manufacturing a variety of products.			

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EE	Estonia	LR	Liberia	SG	Singapore		



## PVA-CONTAINING COMPOSITIONS

The present invention relates to PVA-containing compositions, particularly filled  
5 compositions, to methods of making such compositions and to methods of extruding PVA-  
containing compositions.

There is currently a significant and increasing demand for bio-degradable polymers, to  
replace non bio-degradable polymers which take up an ever greater amount of disposal  
10 space, such as land-fill, or need to be incinerated.

Polyvinyl alcohol (PVA) is one bio-degradable polymer which is in widespread use. As a  
film, PVA shows a high degree of impermeability to a number of gases. Incorporated into  
adhesive, PVA shows high adhesive strength. PVA has significant potential in a wide range  
15 of products. However, the applications of PVA have been limited because there is currently  
no formulation of PVA or PVA-containing composition which can readily be extruded.

While attempts have been made to extrude articles from PVA, it has been found that melt  
extruded PVA becomes very unstable and significant residues become adhered to the  
20 surfaces of the extrusion apparatus, requiring very careful control of process conditions,  
specialised extrusion apparatus and frequent shut down of the extrusion process and purging  
of the apparatus.

It is known to polymerize ethylene with vinyl alcohol to provide a copolymer of ethylene-  
25 vinyl alcohol, in an attempt to retain the desirable properties of PVA whilst simultaneously  
obtaining an extrudable polymer. One such copolymer is marketed under the trade mark  
SOARNOL (registered trade mark of the Nippon Synthetic Chemical Industry Co, Limited).  
However, it is found that this copolymer has effectively lost all of the advantageous  
properties of PVA and is not an effective alternative to an extrudable PVA.

30

A chemically modified PVA is also known and sold as VINEX (registered trade mark of Air

Products). This suffers, however, from the fact that some of the advantageous PVA properties are adversely affected by the chemical modification.

5 The search for bio-degradable polymers is acute in relation to certain sanitary products such as diapers and sanitary towels. However, these products typically comprise superabsorbent materials and at present such materials are only available in combination with conventional non bio-degradable polymers.

10 The present invention is concerned, at least in preferred embodiments, with providing PVA-containing compositions, methods of manufacturing the same and methods of extruding PVA-containing compositions which overcome or at least ameliorate some of the disadvantages identified in the art.

15 Accordingly, a first aspect of the invention provides a PVA-containing composition comprising a blend of PVA and an amount of lubricant effective to render the blend extrudable.

20 The lubricant preferably comprises a fatty acid amide and the composition may advantageously further comprise a plasticiser, the resultant blend being suitable for extrusion in conventional melt-extrusion apparatus. In embodiments of the invention, a PVA-containing composition comprises up to 20%, especially 5 to 15%, plasticizer and up to 5%, especially 0.5 to 2.5%, lubricant, by weight.

25 The composition of the present invention is thus an extrudable PVA-containing polymer, typically with a flexural modulus similar to other extrudable polymers. Known advantageous properties of PVA, such as its high tensile strength, good puncture resistance, and good barrier characteristics are retained in an extrudable composition which can be processed on current extrusion lines, blow-moulders and injection moulders without modification, and without the processing problems such as thermal degradation and high temperature cross  
30 linking, observed in attempts to extrude articles using hitherto known PVA-containing compositions.

In embodiments of the invention, extrudable PVA-containing compositions have been obtained comprising fully hydrolysed PVA as well as partially hydrolysed PVA, and including PVA that is 70% or more hydrolysed.

- 5 Further embodiments of the invention provide PVA-containing compositions in which the molecular weight of the PVA varies from around 20,000, in some cases from around 10,000, to greater than 150,000. Generally, the application of the present invention is not limited to PVA of any particular percent hydrolysis nor of any particular molecular weight.
- 10 A second aspect of the invention provides a filled PVA-containing composition comprising a blend of PVA plus filler. In this composition, the filler is effectively a bulking agent and is relatively inexpensive compared to the PVA, thus a composition is obtained retaining advantageous properties of PVA whilst being cheaper per unit weight to produce.
- 15 In both aspects, the invention preferably provides a PVA-containing composition in the form of pellets or tablets. These preferably have a size of between about 1mm and 5mm in diameter and are suitably obtained by a method of the invention in which PVA, preferably substantially uncompounded and in powder or granular form, is mixed with at least one of lubricant and filler, and optionally other compounding ingredients, and cold pressed to form
- 20 a tablet or pellet. This cold-pressing method is substantially as described in WO-A-98/26911 in relation to different polymers.

With this method, the ingredients can be uniformly mixed and compounded in the correct proportions for the final product, and made into a form that is easier to handle than powder.

- 25 In addition, since the mixture is cold pressed rather than melted, problems of thermal degradation or variation in properties are reduced.

- References to "cold pressing" are intended to imply applying pressure to the powder to cause agglomeration without substantial melting of the polymer. The temperature is preferably
- 30 less than about 100 degrees Celsius, more preferably less than about 70-80 degrees Celsius. Preferably heat is not applied directly to the mixture. However, heat may be generated by

mixing and/or pressing, and this may be allowed to warm the mixture, or cooling may be provided. It is permissible for some heat to be applied directly if necessary to facilitate binding. Some melting of the polymer or other ingredients may occur, particularly on a microscopic scale as a result of pressure at the interface between adjacent particles, but it is  
5 important that the bulk of the polymer granules do not liquefy.

Preferably, the mixture is compressed in discrete quantities into tablets or pellets, for example in a tablet press; this may provide more reliable agglomeration.

10 However, it is possible for the mixture to be extruded under pressure through an orifice, the pellets forming following exit of the mixture from the orifice. In such a case, binder or moisture may be added to the mixture, preferably as the mixture is extruded, or after preliminary mixing of the constituents.

15 Preferably, the mixture is substantially dry, but includes sufficient residual moisture to bind the tablets or pellets on pressing. This avoids the need to add a separate binder, and allows the tablets or pellets to be broken more easily as they enter the extruder simply by drying them further. When water is relied upon for binding, it is desirable to ensure that the tablets or pellets are dried prior to extruding, for example at between 40 and 80 degrees Celsius for  
20 4-8 hours; this alleviates problems of vapour formation during extrusion. The moisture content is desirable to form the tablets, but after forming, the tablets should in most cases retain their shape even when dried.

Preferably, the moisture content is less than about 10% by weight, and preferably greater  
25 than 0.01% by weight, more preferably less than about 5%. If the pellets or tablets are extruded or otherwise formed at relatively low pressures, however, the moisture content may be about 20% or even higher to ensure binding. If the pellets are too moist, they may tend to stick together, inhibiting flow, and drying after forming may be desirable.

30 The moisture may comprise residual moisture in the polymer or in one or more of the compounding ingredients. In this way, moisture can be provided automatically simply by

not drying the ingredients fully prior to mixing.

It is preferred that the filled PVA-containing composition is extrudable, and hence preferred that the filled PVA-containing composition further comprises an effective amount of a  
5 lubricant to render the composition extrudable. The lubricant suitably comprises a fatty acid amide or a plasticiser or a mixture of both a fatty acid amide and a plasticiser.

The lubricant in compositions of the invention is provided so as to improve the thermal stability of the composition under extrusion. The lubricant may be referred to as an internal  
10 lubricant, in that its function is to improve lubrication between the polymer chains. Compositions of the invention may be intended for use in or in connection with food stuffs, and hence it is preferred that the lubricant is approved for food use. It is further preferred that the lubricant is a fatty acid amide, and particularly a straight or branched  $C_{12}$ - $C_{24}$  fatty acid amide, more particularly  $C_{16}$ - $C_{20}$ . Particularly and surprisingly good results are obtained  
15 if the lubricant comprises stearamide, a straight chain  $C_{18}$  fatty acid amide.

The compositions of the invention typically further include a plasticiser, to lower the melt temperature of the polymer under extrusion. The plasticiser may suitably be selected from glycerine, ethylene glycol, triethylene glycol, low molecular weight polyethylene glycols and  
20 low molecular weight amides. A particularly preferred plasticiser comprises or consists of glycerol.

While the proportion of components present may vary in compositions of the invention, embodiments of the invention generally comprise, by weight, up to 50% filler and up to 5%  
25 lubricant. More particular embodiments of the invention comprise, by weight, 5-50% filler, 40-80% PVA, up to 5% lubricant and 5-20% plasticizer.

Compositions of the invention are thus extrudable, but it may be that ease of extrusion depends partly upon the state of the extrusion apparatus, in particular the roughness of  
30 surfaces in the apparatus. In further embodiments of the invention, the compositions comprises an additional lubricant, which may be referred to as an external lubricant, to

prevent or reduce adhesion of the composition to such surfaces. This external lubricant is typically present at 0.001 to 0.1% by weight of the composition and preferably approved for food use, in the same way as the internal lubricant. Stearate salts are suitable external lubricants, in particular magnesium, lead or zinc stearates.

5

Fillers for incorporation into compositions of the invention may suitably be selected from conventional polymer fillers. Typically the filler is an inert, inorganic material and a particularly preferred filler is or comprises talc, calcium carbonate. In a specific embodiment of the invention, this talc may be micronised, such as in particles with a mean  
10 size of about 20 microns and may further be coated, such as with a stearate. One such coated, micronised talc is available from Croxton and Gary as 90T (trade mark of Croxton and Gary).

It is further an option for the filler to comprise or consist of a superabsorbent material. In  
15 a specific embodiment of the invention, described in an example below, a filled PVA-containing composition comprises a superabsorbent which contains cross-linked sodium polyacrylate (available from Alloid Colloids as SALISORB CL31 (registered trade mark)). Filled compositions of the invention may nevertheless contain superabsorbent material of substantially any type. Incorporation of such superabsorbent material confers the particular  
20 advantage that sanitary products such as diapers and sanitary towels, hitherto major components of waste storage sites such as land-fill sites, may now be made of or comprise a significant proportion of bio-degradable material.

A number of water-absorbent compositions are known and suitable for use as the filler in  
25 embodiments of the invention. For example, US Patent numbers 3,954,721 and 3,983,095 disclose preparations for derivatives of copolymers of maleic anhydride with at least one vinyl monomer in fibrous form. The fibrous copolymers are rendered hydrophilic and water-swellaable by reaction with ammonia or an alkali metal hydroxide. US Patent No. 3,810,468 discloses lightly cross-linked olefin-maleic anhydride copolymers prepared as  
30 substantially linear copolymers and then reacted with a diol or a diamine to introduce cross-linking. The resultant lightly cross-linked copolymers are treated with ammonia or

an aqueous or alcohol solution of an alkali metal hydroxide. US Patent No. 3,980,663 describes water-swellaable absorbent articles made from carboxylic polyelectrolytes via cross-linking with glycerine diglycidyl ether. These patents are incorporated herein by reference.

5

European Published Application No. 0 268 498 (incorporated herein by reference) describes a water-absorbent composition formed by causing a substantially linear polymer of water-soluble ethylenically unsaturated monomer blends comprising carboxylic and hydroxylic monomers to cross-link internally.

10

Further examples of water-absorbent compositions are those produced from a copolymer of an  $\alpha,\beta$  unsaturated monomer having at least one pendant unit selected from a carboxylic acid group and derivatives thereof and a copolymerisable monomer. A proportion of the pendant units are present in the final copolymer as the free acid and a proportion as the salt of the acid. These copolymers are capable of being cross-linked, either internally or with a variety of cross-linking agents, to form the water-swellaable composition. Examples of water-swellaable compositions of this type can be found in US Patent Nos 4,616,063, 4,705,773, 4,731,067, 4,743,244, 4,788,237, 4,813,945, 4,880,868 and 4,892,533 and European Patent Nos 0 272 074 and 0 264 208 and European Published Application No. 0 436 514 which are incorporated herein by reference.

15

20

Derivatives of carboxylic acid groups include carboxylic acid salt groups, carboxylic acid amide groups, carboxylic acid imide groups, carboxylic acid anhydride groups and carboxylic acid ester groups.

25

Other examples of water-absorbent compositions can be found in US 4798861, WO93/17066, WO93/255735, WO 93/24684, WO93/12275, European Published Application Nos 0 401 044, 0 269 393, 0 326 382, 0 227 305, 0 101 253, 0 213 799, 0 232 121, 0 342 919, 0 233 014, 0 268 498 and 0 397 410, British Patent Application Nos 2 082 614, 2 022 505, 2 270 030, 2 269 602 and 2 126 591, US Patent Nos 4,418,163, 4,418,163, 3,989,586, 4,332,917, 4,338,417, 4,420,588 and 4,155,957 and French Patent

30

Application No. 2 525 121 which are all incorporated herein by reference.

The extrudable compositions of the invention are suitable for manufacture of substantially any article made using currently extrudable polymers, including films and bottles and any other articles. The compositions are suited to manufacture of filaments and fibre, for use in spunbond, non-woven and melt-blown applications. The composition is suitable also for manufacture of such articles as agri-chem sachets, mulch films, plant pots, domestic bags, diapers, drinking straws, fem care products, hangers, incontinence pads, sachets, six pack rings, disposable clothing, expanded foams, gloves, film canisters, golf tees, shot gun cartridges, bed pans, bottles, bowls, cotton buds, hospital curtains, "one-use" sterile products and packaging materials.

Compositions of PVA have good gas and fossil fuel barrier properties and are particularly suitable for making balloons and disposable packaging for oil and the like.

15

Good results have been obtained with embodiments having the following make up, by weight:-

- (a) 40 to 80% PVA;
- (b) 5 to 50% filler;
- 20 © 5 to 15% plasticiser, preferably glycerol;
- (d) 0.5 to 2.5% lubricant, preferably a fatty acid amide as an internal lubricant, most preferably octodecanamide.

Particularly good results have been obtained in embodiments of the invention having the following make-up, by weight:-

- (a) 40 to 70% PVA;
- (b) 20 to 50% filler, preferably a micronised inorganic material such as talc, preferably coated with stearate;
- © 8 to 15% plasticizer, preferably glycerol;
- 30 (d) 0.5 to 1.5% internal lubricant, preferably a fatty acid amide, most preferably octodecanamide; and



(e) 0.0001 to 0.1 % external lubricant, preferably stearate.

The composition may contain residual moisture, sufficient to enable the composition to be bound as a cold-pressed tablet.

5 Further advantageous results have been obtained in compositions of the invention comprising, by weight:-

50 to 60% PVA;

30 to 40% stearate-coated calcium carbonate;

8 to 15% glycerol;

10 0.5 to 1.5% octadecanamide; and

0.0001 to 0.1% zinc stearate.

In a third aspect, the invention provides a method of making an extrudable PVA-containing composition comprising blending PVA with a lubricant, said lubricant  
15 including a fatty acid amide. The method preferably comprises blending PVA with a fatty acid amide in the presence of an amount of moisture sufficient to bind the composition into tablets or pellets upon cold pressing.

The amount of lubricant blended with the PVA is typically restricted by the fact that,  
20 above a certain percent, excess lubricant separates out from the blend, and generally lubricant is blended at up to 5% by weight of the PVA present. The method thus conveniently enables tablets or pellets of the composition to be prepared as the feedstock for an extrusion. Blending of the components of the composition is achieved using conventional apparatus, one such example being a high speed blender.

25

The method may optionally comprise adding small amounts of moisture to the components to be blended, such as by dripping water into the blend. Preferably, PVA and lubricant are fed into a high speed mixer gravimetrically.

30 In a fourth aspect, the invention provides a method of making a PVA-containing composition comprising blending PVA and a filler, wherein the filler comprises a

superabsorbent material. It is preferred that blending is carried out in the presence of sufficient moisture to bind the composition into tablets or pellets upon cold pressing, the moisture optionally being present in the starting materials of the blend or being introduced into the blend, such as by drip-feeding.

5

A fifth aspect of the invention provides a method of extruding a PVA-containing composition so as to form an extruded product which contains PVA, comprising:-

10

blending PVA with at least one component selected from a lubricant and a filler;  
and

cold pressing the resultant blend into pellets or tablets;

15

wherein the pellets or tablets comprise the polymer feedstock for extrusion of an  
extruded product containing PVA.

20

The PVA is preferably blended with one or more lubricant or filler components in the presence of sufficient moisture to bind the blend upon cold pressing. An advantage of the method is that the PVA-containing feedstock for the extrusion step is obtainable substantially without melting of the PVA. This improves the stability of the PVA during subsequent extrusion. Hitherto, as has been recognised in the present invention, attempts to extrude a PVA-containing feedstock largely failed as the PVA already had a heat history, ie had been wholly or partially melted in processing stages prior to the extrusion stage. The present invention avoids the disadvantage of introducing such a heat history into the PVA-containing composition.

25

A sixth aspect of the invention provides a method of extruding a PVA-containing composition comprising blending PVA and at least one optional component selected from a lubricant and a filler to form a feedstock for an extrusion process, the feedstock being in the form suitably of powder, pellets or tablets, and extruding the feedstock into a product, wherein the feedstock is prepared substantially without melting of the PVA.

30

A seventh aspect of the invention provides a method of extruding a polymer composition containing a heat sensitive polymer, comprising blending the heat sensitive polymer with one or more optional components selected from a filler and a lubricant to form a feedstock for an extrusion process, the feedstock being suitably in the form of powder or pellets or tablets, and extruding the feedstock into an extruded product, wherein the feedstock is prepared substantially without melting of the heat sensitive polymer.

Optional and preferred features of the first and second aspects of the invention are, similarly, optional and preferred features of the third to seventh aspects of the invention.

The invention is now described in the following non-limiting examples.

#### Example 1

A blend of, by weight, approximately 60% fully hydrolysed PVA, 30% calcium carbonate, 10% glycerol, 0.01% zinc stearate and 1% octadecanamide was prepared in a high speed blender. It was found to have a white/cream colour with the following properties:-

density	1.65 g/cm <sup>3</sup>
melt density	1.46 g/cm <sup>3</sup> at 200°C (under ISO 1183)
MFR	357 (10 mins/200°C/21.6 kilograms, under ISO 1133)
melt temperature	200°C
processing temperature	190 - 200°C
residence time	up to 15 minutes
drying time	4 hours at 80°C

#### Example 2

A blend was prepared in a similar way to example 1 of, by weight, approximately 60%

partially hydrolysed PVA, 30% calcium carbonate, 10% glycerol, 0.01% zinc stearate and 1% octadecanamide. This was found to have the following properties:-

	density	1.65 g/cm <sup>3</sup>
5	melt density	1.38-1.40 g/cm <sup>3</sup> at 190°C (under ISO 1183)
	MFR	22 (10 mins/190°C/5 kilograms, under ISO 1133)
	apparent melt viscosity	236/49 (Pa.s 1,000s/10,000s)
	melt temperature	200°C
	processing temperature	190-200°C
10	residence time	up to 15 minutes
	drying time	4 hours at 80°C

### Example 3

- 15 The PVA-containing compositions of examples 1 and 2 were examined for their extrudability in injection-moulding machines made by Brabender, Killion, Windsor, Hesas, Battenfield, Fischer, Demag and Arburg. Extrusion processing was carried out using a single full flight screw with constant pitch. The barrel temperature had a profile of 180-200°C (melt 190-210°C) and the screw speed varied typically between 20 and 120
- 20 rpm. Shut down of the apparatus was carried out by maintaining the temperature for up to 15 minutes with screw rotation stopped, over a period of 3 hours reducing the temperature to 100°C with screw rotation stopped and subsequently completing the shut down by turning the machine off.
- 25 Whether or not a given composition is extrudable (by which is meant on commonplace extrusion apparatus) will normally be clear to one skilled in the art. In the event that a test is required, however, it is suggested that extrudability is determined by attempting extrusion on one or more of the above-named manufacturers machines using a single full flight screw with constant pitch with speeds and temperatures in the above range. If the
- 30 composition extrudes reliably on at least two of the above machines with routine adjustment of parameters, it is to be deemed extrudable; if consistent problems are

obtained and extrusion is only possible under highly specific conditions or on specialised equipment, it is to be deemed not to be extrudable.

The compositions of both examples 1 and 2 were satisfactorily extruded into a range of films and tubes blow-moulded containers of various sizes and colours and injected moulded products.

#### Examples 4-9

10 PVA-containing compositions were prepared as blends of the following components in the amounts shown:-

<b>EXAMPLE</b>						
	4	5	6	7	8	9
<b>Components</b>						
PVA - fully hydrolysed	-	-	-	50	60	55
PVA - partially hydrolysed	50	60	55	-	-	-
Calcium carbonate (coated)	40	30	30	40	30	30
Glycerol	9	9	14	9	9	14
Octadecanamide	1	1	1	1	1	1
Zinc Stearate	0.01	0.01	0.01	0.01	0.01	0.01

#### Example 10

30 A further filled PVA-containing compositions was prepared as a blend of, by weight,

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approximately 60% partially hydrolysed PVA, 30% cross-linked sodium polyacrylate (a superabsorbent), 9% glycerol, 1% octadecanamide and 0.01% zinc stearate.

As far as extrusion apparatus is concerned, it is advantageous to use chrome plated screws  
5 and for the melt flow path to use chrome plated surfaces and gradual tapers to streamline the melt.

The invention thus provides PVA-containing compositions for use in the manufacture of bio-degradable articles. The invention extends to combinations of all features individually  
10 disclosed. In particular, optional or preferred features of any of the apparatus, product or method aspects may be combined with features of other aspects.

CLAIMS

1. A PVA-containing composition, comprising a blend of PVA and an amount of lubricant effective to render the blend extrudable.
- 5 2. A composition according to Claim 1 wherein the lubricant comprises a fatty acid amide.
3. A composition according to Claim 2 wherein the fatty acid amide is a straight or  
10 branched C<sub>12</sub>-C<sub>24</sub> fatty acid amide.
4. A composition according to Claim 2 or 3 wherein the composition further comprises a plasticiser.
- 15 5. A composition according to Claim 4 wherein the plasticiser is selected from ethylene glycol, glycerine, glycerol, triethylene glycol, low molecular weight polyethylene glycols and C<sub>2</sub>-C<sub>8</sub> amides.
6. A composition according to any of Claims 1 to 5 comprising up to 5% lubricant,  
20 by weight.
7. A composition according to any of Claims 1 to 6 comprising up to 20% plasticiser, by weight.
- 25 8. A composition according to any of Claims 1 to 7, in the form of a tablet or pellet obtainable by cold-pressing
9. A filled PVA-containing composition, comprising a blend of PVA plus filler.
- 30 10. A composition according to Claim 9 wherein the filler comprises inert, inorganic material.

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11. A composition according to Claim 9 wherein the filler comprises a superabsorbent material.
12. A composition according to Claim 9 wherein the filler comprises both an inert,  
5 inorganic material and superabsorbent material.
13. A composition according to Claim 9, 10 or 12 wherein the inorganic filler comprises calcium carbonate.
- 10 14. A composition according to any of Claims 9-13 further comprising a lubricant.
15. A composition according to Claim 14 wherein the lubricant comprises a fatty acid amide.
- 15 16. A composition according to any of Claims 14 to 15 comprising, by weight, up to 50% filler, up to 5% lubricant and up to 20% of a plasticizer.
17. A composition according to any of Claims 14 to 16 comprising, by weight, 5-50% filler, 0.5 to 2.5% lubricant, 5 to 15% plasticizer and 40-80% PVA.
- 20 18. A composition according to any of Claim 1-17, further comprising an additional lubricant component to reduce adhesion of the composition to surfaces.
19. A composition according to Claim 18 wherein the lubricant comprises a stearate.
- 25 20. A composition according to any of Claims 9 to 19 in the form of a tablet or pellet obtainable by cold-pressing.
21. A PVA-containing composition comprising, by weight:-  
30 40 to 80% PVA;  
5 to 50% filler;



5 to 15 % plasticizer; and

22. A composition according to Claim 21, comprising, by weight:-  
40 to 70 % PVA;  
20 to 50 % filler;  
8 to 15 % plasticizer;  
0.5 to 2.5 % lubricant. internal lubricant; and  
0.0001 to 0.1 % external lubricant.
23. A composition according to Claim 22 comprising, by weight:-  
50 to 60 % PVA;  
30 to 40 % stearate-coated calcium carbonate;  
8 to 15 % glycerol;  
0.5 to 1.5 % octadecanamide; and  
0.0001 to 0.1 % zinc stearate.
24. A method of making a PVA-containing composition comprising blending PVA with a lubricant, said lubricant including a fatty acid amide.
25. A method according to Claim 24 comprising blending PVA with a fatty acid amide in the presence of an amount of moisture sufficient to bind the composition into tablets or pellets upon cold pressing.
26. A method according to Claim 24 and 25 comprising blending, in a high speed blender, PVA with up to 5 % by weight of lubricant.
27. A method according to any of Claims 24 to 26 comprising adding moisture to the components to be blended, such as by dripping water into the blend.
28. A method according to any of Claims 24 to 27 wherein PVA and lubricant are fed into a high speed mixer gravimetrically.

29. A method of making a PVA-containing composition comprising blending PVA and a filler, wherein the filler comprises a superabsorbent material.

30. A method according to Claim 29 comprising blending PVA and a superabsorbent material in the presence of sufficient moisture to bind the composition into tablets or pellets upon cold pressing.

31. A method of extruding a PVA-containing composition so as to form an extruded product which contains PVA, comprising:-

10

blending PVA with at least one optional component selected from a lubricant and a filler;

cold pressing the resultant blend into pellets or tablets;

15

wherein the pellets or tablets comprise the polymer feedstock for extrusion of an extruded product containing PVA.

32. A method according to Claim 31 comprising blending PVA with one or more optional components in the presence of sufficient moisture to bind the blend upon cold pressing.

33. A method of extruding a PVA-containing composition comprising blending PVA and at least one optional component selected from a lubricant and a filler to form a feedstock for an extrusion process, the feedstock being in the form suitably of powder, pellets or tablets, and extruding the feedstock into a product, wherein the feedstock is prepared substantially without melting of the PVA.

34. A method of extruding a polymer composition containing a heat sensitive polymer, comprising blending the heat sensitive polymer with one or more optional components selected from a filler and a lubricant to form a feedstock for an extrusion process, the

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feedstock being suitably in the form of powder or pellets or tablets, and extruding the feedstock into an extruded product, wherein the feedstock is prepared substantially without melting of the heat sensitive polymer.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02822

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C08K13/02 C08L29/04 //(C08K13/02,5:20,3:26)

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08K C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 206 101 A (WYSONG ROBERT D) 3 June 1980 (1980-06-03) column 4, line 50 -column 5, line 1; claims 1,12; example 1 ---	1-5,33
X	IE 970 280 A (SOLPLAX LIMITED) 24 September 1997 (1997-09-24) examples ---	1,2,5,8, 24,25
X	WO 97 09379 A (SOLPLAX LTD.) 13 March 1997 (1997-03-13) claims ---	1,2,5,8, 24,25
A	WO 96 20973 A (ENVIRONMENTAL PACKING L P) 11 July 1996 (1996-07-11) claims 1,7,8; examples ---	1,8-12
-/--		



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02822

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 713 965 A (WIDIGER A ET AL) 30 January 1973 (1973-01-30)  column 1, line 68 -column 2, line 46; claims 1,4 -----	1-3, 9, 10, 13-15, 18, 19
X	US 3 470 122 A (RIDGEWAY LEE R ET AL) 30 September 1969 (1969-09-30) column 3, line 4 - line 13; claims 1-3 -----	1-3, 9, 10

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/02822

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02822

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 C08K13/02 C08L29/04 //(C08K13/02,5:20,3:26)

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08K C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 206 101 A (WYSONG ROBERT D) 3 June 1980 (1980-06-03) column 4, line 50 -column 5, line 1; claims 1,12; example 1 ---	1-5,33
X	IE 970 280 A (SOLPLAX LIMITED) 24 September 1997 (1997-09-24) examples ---	1,2,5,8, 24,25
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

**\* Special categories of cited documents :**

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

14 December 1999

Date of mailing of the international search report

22/12/1999

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Engel, S

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02822

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 3 713 965 A (WIDIGER A ET AL) 30 January 1973 (1973-01-30)</p> <p>column 1, line 68 -column 2, line 46; claims 1,4</p>	<p>1-3,9, 10, 13-15, 18,19</p>
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